Unit 4
Day 4
Section 8.4
The Binomial Theorem

BINOMIAL COEFFICIENT

For non-negative integers n and r, with $r \leq n$, the symbol $\binom{n}{r}$ is defined as

read n choose r

$$\binom{n}{r} = \frac{n!}{r!(n-r)!}$$

Using the TI-30X to calculate the binomial coefficient we use the nCr feature.

$$\binom{10}{7} = \frac{10!}{7!3!} = \frac{10 \cdot \overset{3}{\cancel{9}} \cdot \overset{4}{\cancel{8}} \cdot \cancel{7 \cdot 6 \cdot 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1}}{\cancel{7 \cdot 6 \cdot 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1} \cdot \cancel{3} \cdot \cancel{2} \cdot 1} = 120$$

USE YOUR CALCULATOR TO DO THE FOLLOWING:

10 , PRB, ->, nCr, =, 7, = This should give you 120.

$$\binom{10}{7} = \frac{10!}{7!3!} = \frac{10 \cdot 9 \cdot 8}{3 \cdot 2 \cdot 1}$$

$${}_{10}C_7 = \frac{10!}{7!3!} = 120$$

Evaluate.

1) By hand: $\dfrac{7!}{3!4!} = \dfrac{7 \cdot \cancel{6} \cdot 5}{\cancel{3 \cdot 2} \cdot 1} = 35$

2) $\dbinom{8}{3} = \dfrac{8!}{3!\,5!} = \dfrac{8 \cdot 7 \cdot \cancel{6}}{\cancel{3 \cdot 2} \cdot 1} = 56$

3) ${}_{100}C_2 = \dbinom{100}{2} = \dfrac{100!}{2!\,98!} = \dfrac{\overset{50}{\cancel{100}} \cdot 99}{\cancel{2}} = 4950$

BINOMIAL THEOREM

For any positive integer n and any complex numbers x and y ,

$$(x+y)^n = \sum_{r=0}^{n} \binom{n}{r} x^{n-r} y^r$$

Refer to p. 603 for Binomial Theorem

USING THE BINOMIAL THEOREM

Write the binomial expansion for each expression.

4)

$(p+q)^5 =$

$p^5 + \binom{5}{1}p^4q + \binom{5}{2}p^3q^2 + \binom{5}{3}p^2q^3 + \binom{5}{4}pq^4 + q^5$

$p^5 + 5p^4q + 10p^3q^2 + 10p^2q^3 + 5pq^4 + q^5$

5)

$$(x-2y)^6$$

$$x^6+\binom{6}{1}x^5(-2y)+\binom{6}{2}x^4(-2y)^2+\binom{6}{3}x^3(-2y)^3+\binom{6}{4}x^2(-2y)^4+\binom{6}{5}x(-2y)^5+(-2y)^6$$

$$x^6-12x^5y+60x^4y^2-160x^3y^3+240x^2y^4-192xy^5+64y^6$$

HOMEWORK

UNIT 4 DAY 4

P. 605-606: 2-26 (EVEN)